

Final Exam: Analyze Three Algorithms

Thursday, 11 December, 1:00pm–3:00pm, Chapman 107

The in-class Final Exam will be a bit different, but fairly short and with a clear path for preparation. I would like you to **summarize and analyze three major algorithms** which we have seen during the semester.

You will have this document in your hand during the Exam, but you must remember what you want to say! **You may NOT bring notes, the textbook, or electronics of any kind** to the Exam. Just bring a writing implement.

You are **strongly encouraged to draft and practice** your planned algorithm summaries. Make sure to read relevant sections of the textbook. Get feedback on your drafts from other students/friends/family/pets, or me. Decide in advance how you will remember enough detail so as to recreate the summary during the Exam itself.

Your summary and analysis should include: Clearly state the problem the algorithm solves, including what properties the input and outputs have. State the algorithm at a high level. What are the main geometric and/or algebraic ideas behind the algorithm? A detailed pseudocode is not *required*, but please either sketch the algorithm's steps in words or give a pseudocode. What is the work estimate? (Use big-O notation appropriately, and give leading-order constants if that is relevant.) If there is a backward stability theorem, summarize what it says. Compare to any other relevant/significant algorithms for the same or similar purposes.

This is a writing assignment. Your goal is an “executive summary,” making sure to point-out all the key ideas. Regard your target audience as a typical student in the first week of this course. I will grade for correctness, completeness, and readability.

Instructions:

Please choose one algorithm from each category A,B,C below, and summarize it. Write each summary on a separate sheet. Identify each by “**A1**”, etc. in the upper-left corner. Put your name in the upper-right corner. Each summary should be more than half a page but at most 1.5 pages. It should be between 250 and 500 words; note that the text on this page above the horizontal line is 267 words.

A = essential matrix factorizations

A1. Householder QR factorization *Alg. 10.1*

A2. Gauss elimination with partial pivoting *Alg. 21.1*

B = least squares solvers

B1. solve least squares via normal equations *Alg. 11.1*

B2. solve least squares via QR factorization *Alg. 11.2*

B3. solve least squares via SVD *Alg. 11.3*

C = eigenvalue computations

C1. reduction of a Hermitian matrix to tridiagonal *Alg. 26.1*